

What is claimed is:

Sub A^a 5
1. A highly scratch-resistant multicoat clearcoat system A for a primed or unprimed substrate, producible by

- 10 (1) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation to the surface of the substrate, and partially curing it, and
- 15 (2) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the surface of the clearcoat film(s) I, and then
- 20 (3) curing the clearcoat films I and II conjointly with actinic radiation and thermally.

25 2. A highly scratch-resistant multicoat clearcoat system A for a primed or unprimed substrate, producible by

- (1) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation to the surface of the substrate, curing it and roughening it,

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- 5 (2) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the outer surface of the clearcoat film(s) I, and then
- 10 (3) curing the clearcoat film II with actinic radiation and, if desired, thermally.
- 10 3. A highly scratch-resistant, multicoat color and/or effect coating system B for a primed or unprimed substrate, producible by
- 15 (1) applying at least one color and/or effect basecoat film III of a pigmented coating material III curable thermally and also, if desired, with actinic radiation to the surface of the substrate and drying it without curing,
- 20 (2) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation wet-on-wet to the surface of the basecoat film III, and partially curing them, and
- 25 (3) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally,

comprising nanoparticles, to the surface of the clearcoat film(s) I, and then

- (4) curing the basecoat film(s) III and the clearcoat films I and II conjointly with actinic radiation and thermally.

4. A highly scratch-resistant multicoat color and/or effect coating system B for a primed or unprimed substrate, producible by

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- (1) applying at least one color and/or effect basecoat film III of a pigmented coating material III curable thermally and also, if desired, with actinic radiation to the surface of the substrate and drying it without curing,

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- (2) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation wet-on-wet to the surface of the basecoat film III,

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- (3) curing the basecoat film III and clearcoat film(s) I conjointly, thermally and with actinic radiation,

- (4) roughening the outer surface of the clearcoat film(s) I,

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(5) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the outer surface of the clearcoat film(s) I, and then

(6) curing the clearcoat film II with actinic radiation and, if desired, thermally.

10 5. A process for producing a highly scratch-resistant multicoat clearcoat system (A) on a primed or unprimed substrate, which comprises

15 (1) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation to the surface of the substrate, and partially curing it, and

20 (2) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the surface of the clearcoat film(s) I, and then

25 (3) curing the clearcoat films I and II conjointly with actinic radiation and thermally.

and to a multicoat clearcoat system

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~~6. A process for producing a highly scratch-resistant multicoat clearcoat system A on a primed or unprimed substrate, which comprises~~

~~5 (1) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation to the surface of the substrate, curing it and roughening it,~~

~~10 (2) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the outer surface of the clearcoat film(s) I, and then~~

~~15 (3) curing the clearcoat film II with actinic radiation and, if desired, thermally.~~

~~7. A process for producing a highly scratch-resistant multicoat color and/or effect coating system B on a primed or unprimed substrate, which comprises~~

~~20 (1) applying at least one color and/or effect basecoat film III of a pigmented coating material III curable thermally and also, if desired, with actinic radiation to the surface of the substrate and drying it without curing,~~

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- (2) applying at least one clearcoat film I of a coating material I curable thermally and with actinic radiation wet-on-wet to the surface of the basecoat film III, and partially curing them, and
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- (3) applying a further clearcoat film II of a coating material II curable with actinic radiation and also, if desired, thermally, comprising nanoparticles, to the surface of the clearcoat film(s) I, and then
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- (4) curing the basecoat film(s) III and the clearcoat films I and II conjointly with actinic radiation and thermally.

8. A process for producing a highly scratch-resistant multicoat color and/or effect coating system B on a primed or unprimed substrate, which comprises

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- (1) applying at least one color and/or effect basecoat film III of a pigmented coating material III curable thermally and also, if desired, with actinic radiation to the surface of the substrate and drying it without curing,
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- (2) applying at least one clearcoat film I of a coating material I curable thermally and with

actinic radiation wet-on-wet to the surface
of the basecoat film III,

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(3) curing the basecoat film III and clearcoat
film(s) I conjointly, thermally and with
actinic radiation,

10 (4) roughening the outer surface of the clearcoat
film(s) I,

15 (5) applying a further clearcoat film II of a
coating material II curable with actinic
radiation and also, if desired, thermally,
comprising nanoparticles, to the outer
surface of the clearcoat film(s) I, and then

20 (6) curing the clearcoat film II with actinic
radiation and, if desired, thermally.

25 9. The clearcoat system A as claimed in claim 1 or 2,
the multicoat system B as claimed in claim 3 or 4,
the process for producing the clearcoat system A
as claimed in claim 5 or 6, or the process for
producing the multicoat system B as claimed in
claim 7 or 8, wherein the coating material II
comprises nanoparticles based on silicon dioxide,
aluminum oxide and zirconium oxide.

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10. The clearcoat system A as claimed in any of claims
1, 2 and 9, the multicoat system B as claimed in
any of claims 3, 4 and 9, the process for
producing the clearcoat system A as claimed in any
of claims 5, 6 and 9, or the process for producing
the multicoat system B as claimed in any of claims
7 to 9, wherein the coating material I comprises

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(a1) at least one constituent containing

(a11) at least two functional groups which serve
for crosslinking with actinic radiation, and
if desired

(a12) at least one functional group which is able
to undergo thermal crosslinking reactions
with a complementary functional group (a22)
in the constituent (a2),

and

(a2) at least one constituent containing

(a21) at least two functional groups which serve
for crosslinking with actinic radiation, and

(a22) at least one functional group which is able
to undergo thermal crosslinking reactions

with a complementary functional group (a12)
in the constituent (a1),

and also, if desired,

(a3) at least one photoinitiator,

(a4) at least one thermal crosslinking initiator,

10 (a5) at least one reactive diluent curable
thermally and/or with actinic radiation,

(a6) at least one coatings additive, and/or

15 (a7) at least one thermally curable constituent,

20 with the proviso that the coating material I
comprises at least one thermally curable
constituent (a7) if the constituent (a1) contains
no functional group (a12).

11. The clearcoat system A, the multicoat system B,
the process for producing the clearcoat system A
or the process for producing a multicoat system B
25 as claimed in claim 10, wherein the functional
groups (a11) and (a21) comprise olefinically
unsaturated groups or epoxide groups, especially
olefinically unsaturated groups, hydroxyl groups
in the case of the functional groups (a12) and

[lacuna] in the case of the complementary functional groups (a22) and isocyanate groups.

- Sub A and
- 5 12. The clearcoat system A, the multicoat system B, the process for producing the clearcoat system A or the process for producing a multicoat system B as claimed in claim 10 or 11, wherein the constituent (a1) comprises a urethane (meth)-acrylate and the constituent (a2) comprises a (meth)acrylate-functional (meth)acrylate copolymer containing free isocyanate groups and/or comprises a (meth)acrylate-functional polyisocyanate.
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- 15 13. The use of the clearcoat system A as claimed in any of claims 1, 2 and 9 to 12, of the multicoat systems B as claimed in any of claims 3, 4 and 9 to 12, of the process for producing the clearcoat system A as claimed in any of claims 5, 6 and 9 to 12, or of the process for producing the multicoat system B as claimed in any of claims 7 to 12, in automotive OEM finishing, automotive refinish, the coating of plastics, furniture coating, and industrial coating, including coil coating and container coating.
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- 25 14. A motor vehicle, plastic part, furniture item or other part for private or industrial use, including a coil or container, comprising at least one clearcoat system A as claimed in any of claims

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1, 2 and 9 to 12, at least one multicoat system B
as claimed in any of claims 3, 4 and 9 to 12, at
least one clearcoat system A produced with the aid
of the process as claimed in any of claims 5, 6
and 9 to 12, and/or at least one multicoat system
B produced with the aid of the process as claimed
in any of claims 7 to 12.